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U1S S2123 S2206

(56) Documents cited
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US 4799049 A US 4724715 A US 4712101 A

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(54) Compound action switch input device eg. for cursor control

(57) The device has a housing 1 with a window 2 through which a cylindrical input member 13 can be contacted by the operator. Member 13 is connected to a further cylindrical member 11 so that the members 11, 13 rotate together in a trough-like carrier 3 but are capable of relative axial displacement. Axial displacement of member 13 is detected by contacts 27a, 27b, 27c and rotation of members 11, 13 is detected by a contact on the lower face of bevel gear 23 moving over a fixed contact pattern. A third input is provided by pressing the member 13 downwardly which rotates the carrier 3 about its supporting bar 5 and closes contact 29. The input device may be incorporated into a computer keyboard to control a cursor and to make other inputs or may be used in a TV remote controller.

FIG. 1

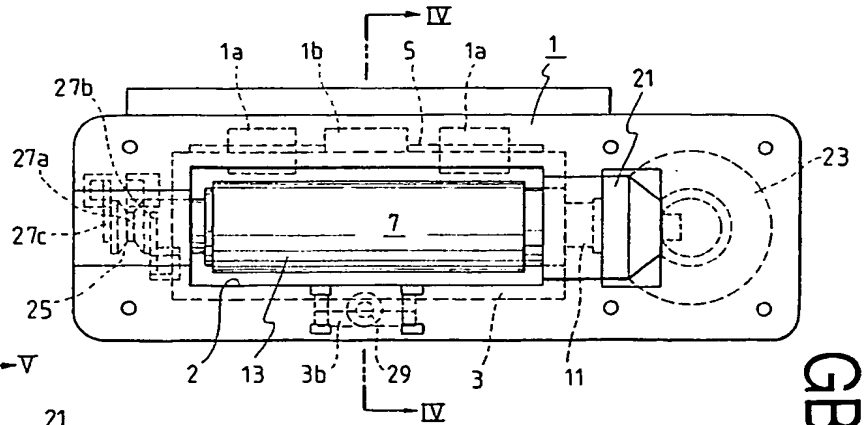
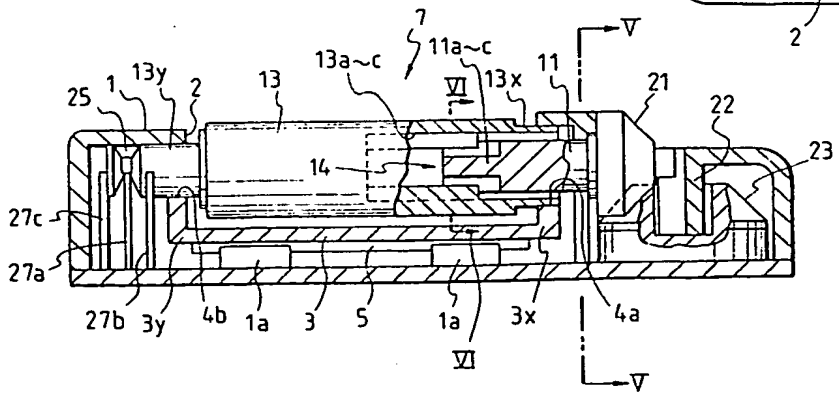


FIG. 2



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG. 1

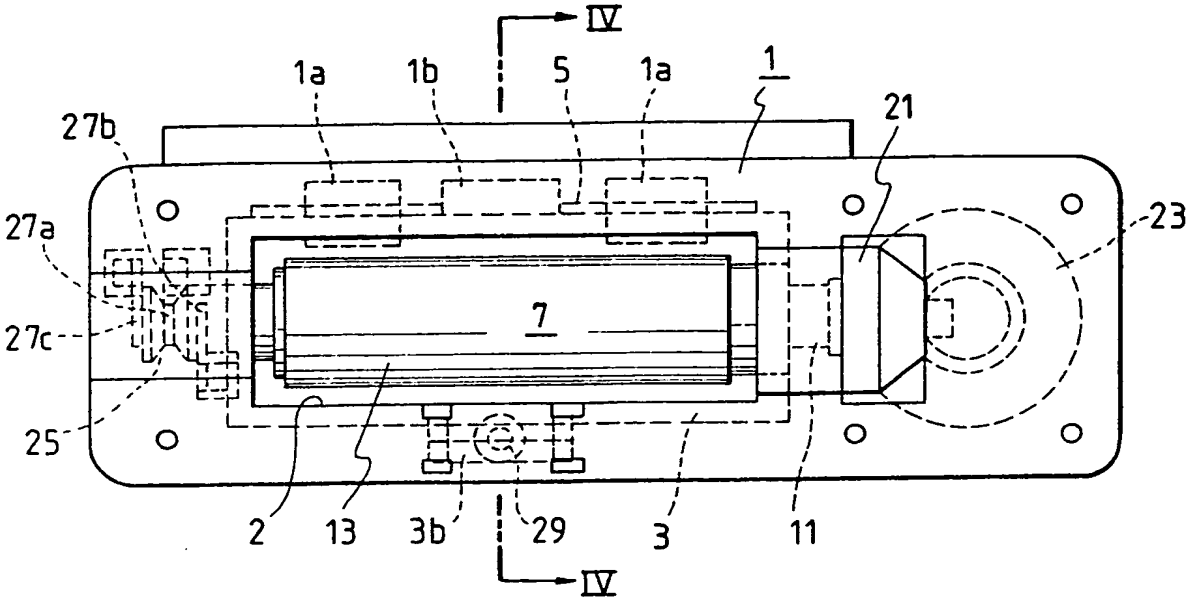


FIG. 2

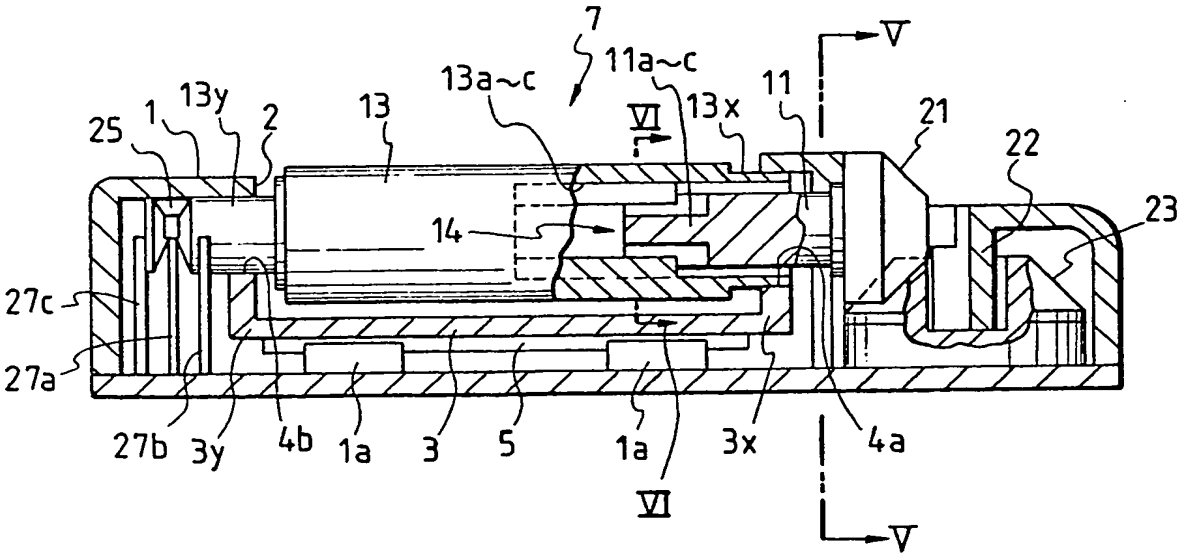


FIG. 3

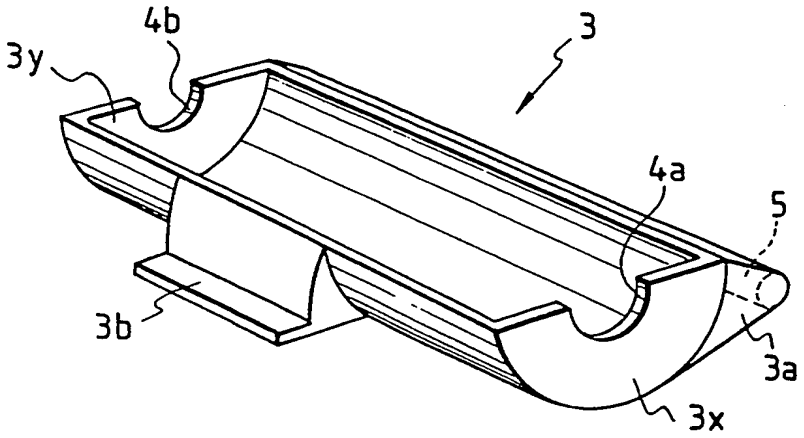


FIG. 4

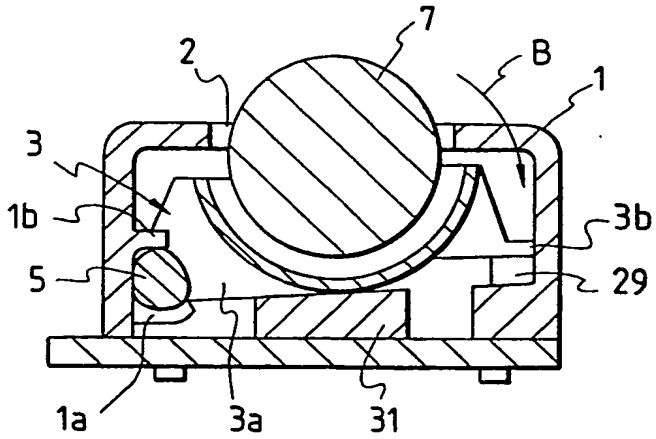


FIG. 5

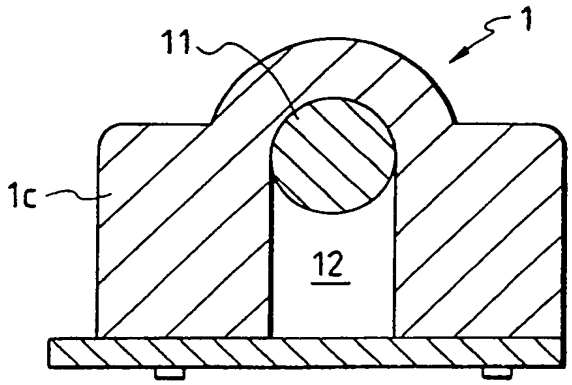
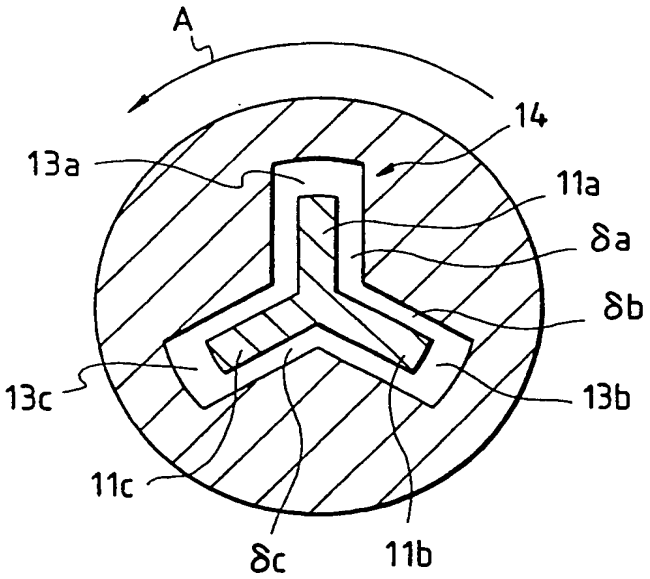


FIG. 6



COMPOUND ACTION SWITCH

This invention pertains to a compound-action switch which may be used, for example, for displacing, in any direction, the image on a display unit (referred to as "cursor").

A known conventional compound-action switch for displacing a cursor on a display unit in a given direction, is disclosed in Japanese Utility Model Gazette 9061 of 1991.

In this sort of so-called "joy stick" compound-action switches, throwing a lever supported on a gimbal in a given direction permits displacement of the cursor in any direction. In another switch, so-called "mouse" switch, turning of a freely rotating steel ball on a table allows turning of two rollers, the rotating angles of which are each detected and converted into an electrical signal in order to displace the cursor.

The conventional composite switches as described above, are intended to move the cursor in given directions; hence another operation key has had to depressed for input operation after displacement of the cursor.

It is an object of this invention to provide such a compound-action switch that solves the above problem of the prior art enabling various options by manipulation of the same switch.

According to the present invention, a compound-action switch comprises a housing having a window; a rod-like composite body, including first and second manipulation bodies, which is fitted in the housing so that the outer circumference of the second manipulation body projects partially out through the window for manipulation, the first and second manipulation bodies interlocking for rotation together but being axially movable relatively to one another; a first detect mechanism provided in the housing, and arranged to detect rotation of the first and second manipulation bodies together; a second detect

mechanism, provided in the housing and arranged to detect axial displacement of the second manipulation body relatively to the first manipulation body; and a third detect mechanism arranged to detect displacement of the second manipulation body in a direction substantially perpendicular to the axis of the composite body.

Compared to a conventional switch, a third detect mechanism is provided.

The single compound-action switch according to this invention can therefore control, with extreme ease and simultaneously, both the displacement of a cursor on the screen of a display-unit and an input operation.

In the accompanying drawings:

Figure 1 is a plan view showing an embodiment of a compound-action switch according to this invention;

Figure 2 is a longitudinal sectional view showing the same switch;

Figure 3 is a perspective diagram showing a mobile body;

Figure 4 is a partial cross section taken on the line IV-IV in Figure 1;

Figure 5 is a cross section taken on the line V-V in Figure 2; and,

Figure 6 is a cross section taken on the line VI-VI in Figure 2.

Referring to the drawings, a plastic housing has a window 2 and contains a mobile carrier body 3 that is formed like a trough as shown in Figure 3. On a side of the mobile body 3, there project parallel to each other a pair of ear pieces 3a, between which a supporting bar 5 is fixed to couple them.

As is clear from the figures 1 and 4 the supporting bar 5 is inserted between two receiving pieces 1a and a retaining piece 1b that project in the housing 1. The receiving pieces 1a support the supporting bar 5, while the retaining piece 1b bears down on the same bar from above

thus allowing the mobile body 3 to pivot in the direction of the arrow B with the bar 5 as the pivot centre.

As shown in Figure 3, one of the end walls 3x of the mobile body 3 has a rather large recess 4a, while the other end wall 3y has another, rather small recess 4b. As is clear from Figure 2, these grooves 4a and 4b support a rod-like, freely rotatable composite manipulation body 7 consisting of a first manipulation body 11 and a second manipulation body 13. In the second manipulation body 13, the diameter of one end 13x is larger than that of the other end 13y, 13x being held in the larger recess 4a and 13y in the smaller recess 4b. A part of the circumference of the second manipulation body 13 extends out through the window of the housing 1.

In Figure 5, the first manipulation body 11 is shown inserted, from below, into a U-shaped groove 12 formed in a partition wall 1c of the housing 1. This arrangement prevents the manipulation body 11 from moving horizontally. Bevel gears 21 and 23, as described later, keep it from slipping vertically out of place.

As seen in Figure 2, the second manipulation body 13 is hollow at its right hand end portion into which the left hand end portion of the first manipulation body 11 has been fitted loosely with some play. A keying portion 14 connecting the first and second manipulation bodies 11 and 13 has been constructed as shown in Figure 6. At the edge of the first manipulation body 11, integrally formed ribs 11a, 11b and 11c extend radially into discrete directions in such a way that they can engage in complementary slots 13a, 13b and 13c that are formed at the end of the second manipulation body 13.

To rotate both the first and second manipulation bodies 11 and 13 together, one only has to turn the second body 13 in the direction of the arrow A. When the manipulation body 13 rotates in the direction A, the ribs 11a-11c of the first body 11 contact respective ones of the lateral walls of the slots 13a-13c of the second body 13 so

that the first body 11 is also turned. The manipulation bodies are thus interlocked.

The interlocking engagement is extremely smooth between the first and second manipulation bodies 11 and 13 because there exist gaps δa to δc between the manipulate bodies 11 and 13 at the keying portion 14, as is clear from Figure 6.

Further the first and second manipulation bodies 11 and 13 can be relatively displaced in the direction orthogonally of their respective axes, when the body 11 is fitted into the U-shaped groove 12 of the partition wall 1c, and, at the same time, vertically supported through the bevel gears 21 and 23, while the second body 13 is sustained by the mobile body 3. If therefore the body 7 is pressed down near its centre, only the second body 13 goes down with the mobile body 3, the first body 11 remaining fixed.

Although the mobile body 3 swings in the direction of the arrow B (in Figure 4) around the supporting bar 5, the relative displacement between the first and second manipulate bodies 11 and 13 is very smooth because there are required gaps formed between the tips of the ribs 11a to 11c of the first body 11 and the walls of the slots 13a to 13c of the second body 13, as shown in Figure 6.

To the end of the first manipulate body 11 is connected the driving bevel gear 21 which is engaged with the driven bevel gear 23 that rotates about a vertical shaft 22.

On the lower face of the driven bevel gear 23, is fixed a mobile contact (not shown), and a pattern is printed on a substrate opposing the moving contact. As the moving contact moves on the pattern with the rotational movements of the gear 23, different signals are emitted depending upon the rotational angles. The signals thus representing certain angles of rotation. This arrangement provides a first detect mechanism which comes into operation when the first and second manipulation bodies 11

and 13 rotate together to detect their rotational movements. This mechanism may be considered a rotary encoder.

At the end of the second manipulation body 13, is provided a V-shaped annular groove at the side of which are arranged a plate-spring shaped moving contact 27a and two fixed contacts 27b and 27c.

As the groove 25 moves left and right with the displacement of the second manipulation body 13, the moving contact 27a, having a horizontal arm fitted into the upper part of the V-shaped groove 25, deflects to contact with one of the two fixed contacts 27b and 27c. This arrangement provides a second detect mechanism which senses axial displacement of the second manipulation body 13.

In another embodiment of this invention the mobile body 3 may be so constructed that it may move with the axial displacement of the second manipulate body 13. In this version the mobile body 3 may be coupled to the moving contact.

The mobile body 3 freely swings around the axis of the supporting bar 5. As shown in Figure 4, the mobile body 3 has been so designed that when it swings in the direction of the arrow B, a ledge 3b energizes a contact 29 provided on the bottom of the housing 1. This construction constitutes a third detect mechanism which detects the displacement of the mobile body 3 when it swings.

The configuration is such that under normal operational conditions the mobile body 3 may be supported by, for instance, a rubber cushion 31 in such a manner that the contact 29 is only energized when sufficient downward force is applied to squeeze the cushion 31.

Now we will describe the working of this embodiment.

The compound-action switch is incorporated into, for example, a keyboard and is used to move the cursor on a display unit in a given direction and, at the same time, to execute an input operation after the cursor movement. Further in a remote controller for TV that does not require

any cursor control, the compound-action switch may be employed to switch the channel in response to the rotational direction or to adjust the sound volume.

If the first and second manipulation bodies 11 and 13 forming the manipulation body 7 are rotated together by turning the second body 13, the driven bevel gear 23 turns accordingly through the intermediary of the driving bevel gear 21. Provided on the lower face of the driven bevel gear 23 is a moving contact (not shown) which, when rotated, causes a signal to be emitted corresponding to the angle of rotation of the driven bevel gear 23, thus representing a certain angle of rotation of the body 7.

When the second manipulation body 13 is moved axially, the V-shaped groove 25 moves right or left in the figure to thus bend, right or left, the moving contact 27a engaging the groove 25. Thus the moving contact 27a touches either of the two fixed contacts 27b and 27c, which are the contacts of the second detect mechanism. While the moving contact 27a touches one of these contacts and presses against it, a signal is emitted continuously. In the example as shown, when the second body 13 moves horizontally to the right in Figure 2, the moving contact 27a comes to touch the contact 27b, and if it moves to the left, the moving contact 27a touches the contact 27c.

The respective signals as described above are input into, for instance, the controller (not shown) of a display unit, where they are so processed that a cursor on the screen of a display unit is displaced in a given direction. If the mobile body 3 is swung after the movement of the cursor in any direction, the contact 29 is energized. The contact 29, which is the contact for the third switch mechanism that performs the input operation, is not energized when a light pressure is applied during rotation of the manipulate body 7, but is energized only when the mobile body 3 is swung in such a way as to squeeze the cushion 31.

In this embodiment where the composite manipulation body 7 consists of the first and second manipulation bodies 11 and 13, which can be displaced in two directions either together or individually, and the mobile body 3 sustaining the composite body 7 is formed so as to be freely displaceable, the first, second and third switch mechanisms being coupled for movement in their respective directions of displacement, the switch can control, only at one point, both the displacement of a cursor on the screen of a display unit and carry out an input operation in a manner by far easier and simpler than in any conventional composite switches. Moreover the switch has a number of beneficial effects such as an extremely facile assembly of the switch into, for example, remote controllers or keyboards, because a single housing, into which all the components have been accommodated, can be incorporated as such in any remote controller or keyboard.

Modifications are possible, for example, in the foregoing embodiment the mobile body 3 is supported so as to swing freely. It is possible that the same body 3 be supported by a spring or cushion in such a fashion that it can be freely displaced in vertical and other directions.

The connecting portion 14 of the first and second manipulation bodies 11 and 13, consists of three ribs and three slots in this embodiment. Instead a rotational force may be transferred by connecting the ends of the first and second manipulation bodies 11 and 13 with the ends of a spring intervening at the connecting portion 14 to thus allow free displacement of the manipulation bodies both in their axial direction and the direction orthogonally intersecting their axes by means of the deflection of the spring.

CLAIMS

1. A compound-action switch comprising a housing having a window; a rod-like composite body, including first and second manipulation bodies, which is fitted in the housing so that the outer circumference of the second manipulation body projects partially out through the window for manipulation, the first and second manipulation bodies interlocking for rotation together but being axially movable relatively to one another; a first detect mechanism provided in the housing, and arranged to detect rotation of the first and second manipulation bodies together; a second detect mechanism, provided in the housing and arranged to detect axial displacement of the second manipulation body relatively to the first manipulation body; and a third detect mechanism arranged to detect displacement of the second manipulation body in a direction substantially perpendicular to the axis of the composite body.

2. A switch according to claim 1, wherein the composite body is rotatably mounted in a mobile body which is arranged to swing in the housing, the third detect mechanism being arranged to detect displacement of the mobile body.

3. A switch according to claim 2, wherein the mobile body is supported by a cushion which supports the mobile body against swinging during rotation of the composite body but gives to allow the mobile body to swing when the second manipulation body is displaced in the direction substantially perpendicular to the axis of the composite body.

4. A switch according to claim 2 or claim 3, in which the mobile body is formed as a trough in which the composite body is received, the trough having on one side a

longitudinal supporting bar providing a pivot about which the mobile body is arranged to swing.

5. A compound-action switch, substantially as described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Controller under Section 17 (The Search Report)

Application number
GB 9221285.1

Relevant Technical fields

(i) UK Cl (Edition K) F2Y (YTA)

(ii) Int Cl (Edition 5) G05G 9/00, 9/02, 9/04; G06F 3/033; G06K 11/18; H01H 25/00, 25/06

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Search Examiner
J L TWIN

Date of Search
16 NOVEMBER 1992

Documents considered relevant following a search in respect of claims 1

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
	EP 0382353 A2	(HEWLETT PACKARD)	1
X	WO 87/06733 A	(CULVER) See eg. page 11, lines 25-35	1
X	US 4982618	(CULVER)	1
	US 4799049	(AVILA)	1
	US 4724715	(CULVER)	1
X	US 4712101	(CULVER) See eg. Figures 7a-7c; column 10, line 36 - column 11, line 8	1

Category	Identity of document and relevant passages	Relevant to claim(s.

Categories of documents

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P: Document published on or after the declared priority date but before the filing date of the present application.

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